A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

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Founded in 1853

A JOURNAL OF NATURE AND MAN **PACIFIC DISCOVERY** IN THE PACIFIC WORLD

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PRE-DISCOVERY

"ALL OF US at the flying field knew at least something about the feelings of the five young men in the air. We understood that restraining mixture of enthusiasm and dread, of thrill and fear. It had kept them silent at breakfast, silent as they waited for the plane—except for one, usually the most carefree of them all, who kept repeating two lines of a hymn. They were about to do the dangerous thing they had spent days in preparing to do: they were going to make their first parachute jump from an airplane. . . On the landing field next morning . . . wishing to be sure of each stage of the jump, I said to them, 'First you hook the static line of your parachute pack to the static line cable inside the plane. You sit in the door with your right foot on the step—then what do you do?' *'Pray!'* " Training recruits for the paratroops? Yes and no. The hazards in store for these young fellows, when they go into action from the air, equal those any airborne combat team faces dropping behind enemy lines. On the toughest possible landing ground, forested mountainsides, they will close with an enemy more terrible than armed men—*fire.* A professor of English who spent three summers on fire lookout in the Northwest became interested in their story, visited the smokejumpers' training station at McCall, Idaho, interviewed the boys, their officers, and other Forest Service men, learned the beginnings and growth of this newest strategem against fire. "Smokejumpers," by Ella E. Clark of the State College of Washington, will be our July-August Conservation feature.

DISCOVERING PD'S AUTHORS

The Elk of North America is **Olaus J. Murie's** new book just published (Stackpole & Heck, Inc., Harrisburg, Pa., $6.50). North American elk—wapiti—in South Island took Mr. Murie to New Zealand. This leading conservationist, field naturalist, director of the Wilderness Society, headed an international expedition into one of the ruggedest wild areas on earth, "New Zealand's Fiordland," to find out how some four-footed immigrants fared in a new home. . . . ¶For a marine biologist-writer-photographer, **M. Woodbridge Williams** is ideally situated. From his Inverness home-laboratory he can go down the street to Tomales Bay and fish up for *PD* another aquatic curiosity, like *"Cyphonautes:* the Bent Sailor." . . . ¶A long jump from the Pacific Coast to the Rockies lands us on the stamping grounds of an inland writer-photographer and naturalist, **Peyton Moncure** of Missoula, Montana, U. S. Forest Service photographer at Region One headquarters. "Yellowstone's Beggar Bears" is a brief word calculated to foster reciprocal good relations between bears and men. . . . ¶Everybody sees the bears, all over the place, on his tour of the national park. He also sees the mountains; he sees the forests on the mountains—but he probably drives from West Yellowstone to Cody, from Mammoth Hot Springs to Jackson Hole with never a glimpse of the forests *within* the mountains. **William B. Sanborn** of the University of Washington College of Education, Collaborator with the National Park Service, saw and explored the edges of those "Groves of Stone" during summers as Yellowstone ranger-naturalist. . . . ¶**Howard Hinde's** address is not "Jungle Ghost-Town" but the Dudley Herbarium of Stanford University. . . . ¶**Benjamin Draper,** executive producer of the Academy television show "Science in Action," who hails from Denver, got interested a few years ago in the naming of Gray's Peak in the Rockies. Asa Gray, Ben found, traveled across the continent in 1872 gathering material for an address as president of the A.A.A.S. Wanting to verify this date, recently, Ben turned up in the Academy Library's rich Western natural history files the record of an unpublicized later trip of Gray's, in 1877 with another great botanist, Sir Joseph Dalton Hooker. One thing leading to another, their picture posed at "Tea-Time in the Rockies" is, we think, here first in print. D.G.K.

IN THIS ISSUE

THE COVER COPY

Black bear *(Euarctos americanus)*—the pose is familiar to every zoo visitor, but Lloyd G. Ingles got this fellow near Tuolumne Meadows in the High Sierra. He appears on the jacket and as Plate IV of Dr. Ingles' *Mammals of California* (Stanford University Press, 1947.)

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The Greeks Had a Word For It

"Then you should say what you mean," the March Hare went on.

"I do," Alice hastily replied; "at least—at least I mean what I say—that's the same thing, you know."

"Not the same thing a bit!" said the Hatter.

Alice in Wonderland

SEMANTICS is the science and philosophy of meaning and its communication. The problems involved are as old as the human race, but the word itself is relatively new to the English language, and is still sufficiently unfamiliar that bright undergraduates can use it to confound their elders. Semantics, like mathematics, is plural in form but is followed by a singular verb; and, as the study of meaning, it may be coördinated with mathematics, which is the study of quantity and relation without reference to meaning.

Some years ago we heard of a man who took the trouble to educate a puppy in reverse English. After a few weeks of intensive training, the dog became conditioned to perform the exact opposite of various simple commands. When called, it would go away; when told to go away, it would approach happily with tail wagging; when told to sit up, it would lie down; when told to lie down, it would sit up and beg. The "meaning" of the words was, for the dog, simply what they had come to mean in its own experience.

This is all that anybody needs to know about semantics. But, like most writers who take up the subject, having got to the essence of the matter, we can't stop; some strange inner compulsion drives us on to endless elaboration and detail.

Semantics as a word began to creep into English dictionaries in the second and third decades of the twentieth century. It comes directly from the French *sémantique* and indirectly from the Greek *sema,* meaning a sign. It is interesting to note that the English word "significance" comes from the Latin *signum,* also meaning a sign. (Railroad fans may compare *sema*phore and *sig*nal.) Thus by devious routes and after many centuries a Greek word and its Latin counterpart have gravitated together to give us *semantics* and *significance*—two English words that are mutually explanatory. Such is the romance of language.

But wait! Have we not already, in four paragraphs, fallen into a state of semantic confusion? From the story of the dog we concluded that words have meaning only in terms of experience, while in our brief rhapsody on language we seem to have implied that words have meaning in terms of their history. Not to be caught on the horns of this dilemma, we may reply that a knowledge of history is one form of experience. Nevertheless it is worthy of note that many lengthy and useless debates have hinged on what words *really* mean (historically and etymologically) in contrast to what people *think* they mean (current usage). In *Through the Looking Glass,* Humpty Dumpty could tell Alice, "When I use a word, it means exactly what I choose it to mean—neither more nor less." But in this workaday world, what a word means is not what we intend it to mean but what it means to the people we are addressing.

The premise that meaning is not something inherent in words themselves, but something that is learned through individual education and experience, leads to some rather troublesome conclusions. It follows that the same word is likely to mean different things at different times and places, and different things to different persons at the same time and place. Thus "Yankee" is a term of pride in New England, but one of opprobrium in the deep South, where it is usually compounded with a four-letter prefix (a girl from Florida affirms that she grew up and went away to college before she learned that damnyankee was two words!). Recently we overheard a lady who had attended a sunrise Easter service comment, "It really was very impressionistic." The idea created in the minds of the hearers was obviously not the one she intended to convey.

Indeed, when we consider the essential uniqueness of individual experience, it is difficult to be sure that any given word means precisely the same thing to any two persons. If I say "a beautiful home," I may be thinking of a Victorian mansion with rose-colored silk drapes, a square piano, furniture upholstered in horsehair or red plush, and a portrait of a bewhiskered ancestor above the fireplace; you may be thinking of a shed-roofed structure with two sides glass, furniture by Aalto, and a painting by Georges Braque. If I write "a midsummer night," one reader may think of Shakespeare, another may recall how hot the nights get in Washington, D.C., and a third may remember a date he had with a girl from Portland in 1912. After a brief study of semantics, one is likely to conclude that communication of ideas through the medium of words is wholly impracticable, and that the only hope of making himself understood is to resort to sign language.

But further reflection will show that even sign language is a broken reed. One cannot escape semantic difficulties by abandoning words. There might somewhere be a tribe that indicates anger by smiling and friendship by threatening gestures and ferocious looks. It is well known that some Oriental peoples smile when they are sad, nod their heads when they mean no, and wave the hand as a signal to approach instead of a gesture of goodbye. Among Occidentals, it is not at all uncommon for adults to show their friendliness toward babies by making faces and wiggling their ears. These aurifacial gymnastics are occasionally interpreted by a baby as indicative of good will, but would not be so interpreted if one tried them on a traffic cop.

We may sigh with either sadness or contentment, and shed tears of happiness or grief. Laughter may signify joy, good-fellowship, superiority, mockery, or even hysteria.

Sign language – alas! – appears to have all the drawbacks of verbal communication, together with some more of its own. Semantics, pursued to its logical end, would seem to lead to the abandonment of all efforts at communication, and the disillusioned semanticist might easily sink into a confirmed state of silent and melancholy introspection, a condition for which we suppose the correct term would be *semantia praecox*. The subject had best not be pursued this far.

As a matter of fact, few subjects can safely, or ought to, be pursued to a logical end. To a thoughtful conclusion–yes; to an intelligent conclusion–yes; but to a logical conclusion–no! Logic is an intellectual treadmill which takes the mind round and round in the same course, perpetually restraining it from new avenues of adventure, and leading it nowhere.

Happily, semantics is not bound by logic, for a first principle of semantics is that words must be accurately defined, and logic is undefinable. The *Century Dictionary*, after a feeble effort, confesses lamely: "The definition of logic has been much disputed. . . There was much discussion in ancient and medieval times of the question whether logic was a mode of knowing, or an instrument of science, or an art, or a practical science, or a speculative science. . . In modern times, especially since Kant, the real divergence of conception has been very much greater. . ." Brethren, let us not exercise ourselves over logic till somebody can tell us what it is!

In the meantime let us get back to semantics, and to the definition we rashly set forth in the first sentence of this disquisition. The semantic process has two aspects, *meaning* and *communication*. The first of these is individual, the second is social. And so long as the semanticist remembers this second aspect of his calling, he is in no danger of falling into the state of introspective detachment we have warned against above. Semantics involves the contemplation, not of meaning alone, but of meaning as an avenue of communication.

The first step in the semantic process is a reasonably clear conception of the meaning one wishes to convey. Generally, though not always, this concept will be verbal. We do not discount the possibility, nor the importance, of nonverbal thinking. We frequently hear, and occasionally use, such expressions as "wordless anger," "voiceless aspiration," "unspoken desires." It is not always clear whether nonverbal thoughts are really thoughts or simply emotions; but they do occur, they are important in our lives, and they can be communicated – through music, painting, sculpture, the interpretive dance, and in the well known and commonly more unpleasant phenomenon of mob psychology.

Those who doubt the possibility of nonverbal thinking need to be reminded of the common experience of trying to think of a word. One has in mind an idea he wants to express, but the word eludes him. There is a sense of discomfort and of mounting tension, rising even to the level of muscular strain. Suddenly the right word comes, and there is an immediate feeling of relief and satisfaction. The idea has found a word.

John Dewey has pointed out that, until we have a word to express a thought, the thought itself is vague, amorphous, incapable of being resolved. As soon as we find a suitable word for it, the idea becomes crystallized, fenced in, meaningful, capable of being discussed and transmitted to others. Much of the success of psychiatry is due to this single phenomenon–the expression in words of nonverbal desires, frustrations, and fears which have hitherto expressed themselves on the emotional level.

Words, and the ability to use words to convey meaning, represent one of the relatively few attributes that distinguish man from his animal forebears. Let him use the priceless gift of language with proper appreciation of its twofold function– to promote clear thinking and accurate communication.

R.C.M.

NEW ZEALAND'S F

The official hunters found it hard going at times in the high country. View in Henry's Saddle.

(All photographs courtesy National Publicity Studios, Wellington, N. Z.)

On the southwest coast of the South Island, almost as far south as you can go in New Zealand, lies a little-known country called the Fiordland. Ornithologists, botanists, and other scientists had rather meager knowledge of this wilderness. Perhaps it was best known to a group of hardy New Zealand stalkers, who had penetrated portions of it in pursuit of trophies. To add to the interest in this country, a small group of wapiti from the United States had been released there in 1905. In that year some seventeen head of these animals had survived the long ocean voyage, across the Equator and over the curvature of the earth, to a land entirely foreign to them. The ship had entered George Sound, and there the animals had been dumped overboard, to swim ashore and face a strange jungle forest such as they had never seen before.

In more recent years a keen explorer, a man of endless vitality and interest in the far places, visited New Zealand and became fascinated with the problem of learning just what had become of those wapiti. Colonel John K. Howard had had much experience in the Pacific countries during the war and became pretty well acquainted with New Zealand. He had visited Fiordland several times, and it was his enthusiasm and the interest of certain New Zealand authorities that led to the organization of the New Zealand-American Fiordland Expedition in 1949. My own part in it was made possible by a Fulbright grant for a six months stay.

A considerable party of packers and camp experts, accompanied also by Colonel Howard, spent several weeks on the Stillwater River, establishing a base camp and advance camps, in preparation for the corps of scientists.

The scientific party entered the field February

FIORDLAND

OLAUS J. MURIE

What happens when
a big game animal is transplanted
from its native continent to an
island wilderness half way around
the world?
A team of New Zealand and American
scientists stalked the wapiti
on South Island's cliffs
—to find out

George Sound
zigzagged northwestward
from our survey point on Saddle Hill.
With our maps we could orient the landscapes from
such heights. Left to right: Ralph Kean, Lindsay Poole,
the author, Baughan Wisely.

27. My son Donald went with me as field assistant, and Mrs. Murie acted as secretary for the Expedition, at Invercargill—with Colonel Howard we constituted the American contingent. New Zealand, however, furnished the corps of sturdy woodsmen who kept us supplied and collected deer specimens, a staff of scientists representing many technical disciplines—botany, mammalogy, ornithology, geology, entomology, to mention some—and a land survey crew. These were able men, who ranked high in their professions. For the Fiordland was little known and knowledge was desired in many fields.

I can not hope to tell adequately about Fiordland. It is to me as much an experience as it is a country. On a previous trip Colonel Howard had determined that pack horses could not be used. Everything—tents, supplies and equipment—had to be packed into the back country by human brawn, but there was plenty of that! The mountains rose about us to 5,000 feet or a little more, so steep and rough that you carefully picked a route when you decided to go up to timber line and the "tops." And everywhere up to timber line was the native New Zealand bush, here consisting of a heavy rain forest, predominantly silver beech. And then—the crowning feature – the incessant rain! Something like 250 inches of it falls each year, sometimes more, I am told. I might mention that there were also sand flies.

In the ten weeks that we explored this fascinating and maddening country we came to know some of it intimately. Leslie Clearing was our first camp, conveniently situated close to timber line. I think most of us would agree this was our favorite place. Timber line is always exhilarating, and here we were blessed with a number of days of glorious sunshine. I remember one such day when we lay on a grassy slope, on the tops, looking over the country with our telescope, working out the drain-

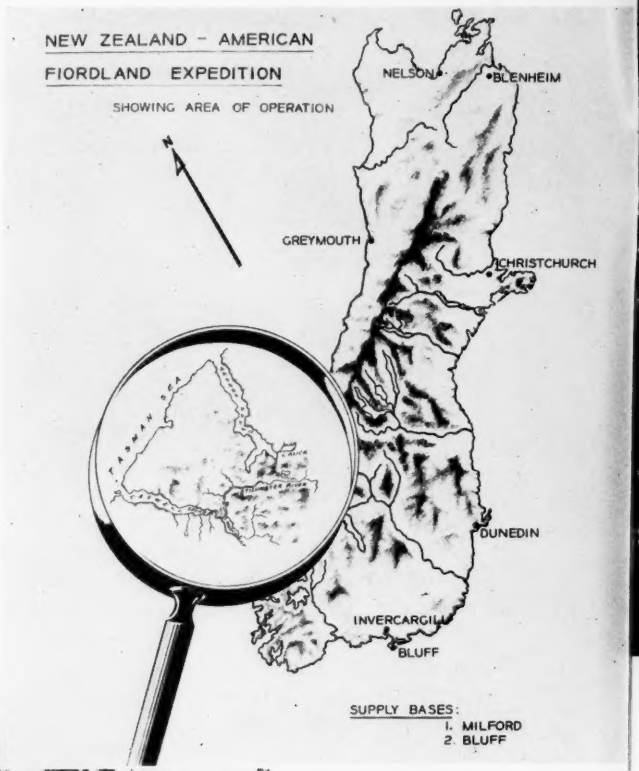
ages in the jumbled mountains before us. It was a time to remember in the rainy spells that befell us later.

One day Lindsay Poole and I climbed to the tops back of camp to try for wapiti specimens. We had pretty good going this time, and presently worked our way through the belt of stubborn timber-line scrub so characteristic here. We spied the wapiti, well up on the ridge, and made our detour for the stalk. It was then that I became impressed with a characteristic of this country. I had a chance to shoot two animals—but it was futile success. So steep was the terrain that both of them fell over the edge and disappeared in the depths far below. I could not even sight them where they fell.

A few days later two members of our party watched a wapiti bull, apparently in full vigor, fall over a cliff to his death, and on the same day found the remains of another below a sheer drop.

As I looked over this up-ended country, and contemplated the hazardous terrain, I thought of the benign high meadows in the Rocky Mountains, where the ancestors of these New Zealand wapiti immigrants had grazed luxuriously on gentle slopes and had wandered at will wherever they pleased. How did this land under the Southern Cross appeal to these descendants? Would they make a go of it? Well, that's what we were here to find out.

I was confronted with a serious problem. When I arrived in New Zealand I had only the vaguest idea about the flora. In the preliminary weeks I'd had helpful suggestions from Mr. C. M. Smith, Chief Inspector of the State Forest Service. And I had been afield with a number of botanists. One of the fundamental aspects of a study of this



Map of South Island with inset showing deep fiords on the southwest coast where the author's expedition hunted wapiti. The Milford base is hidden by the upper rim of the glass.

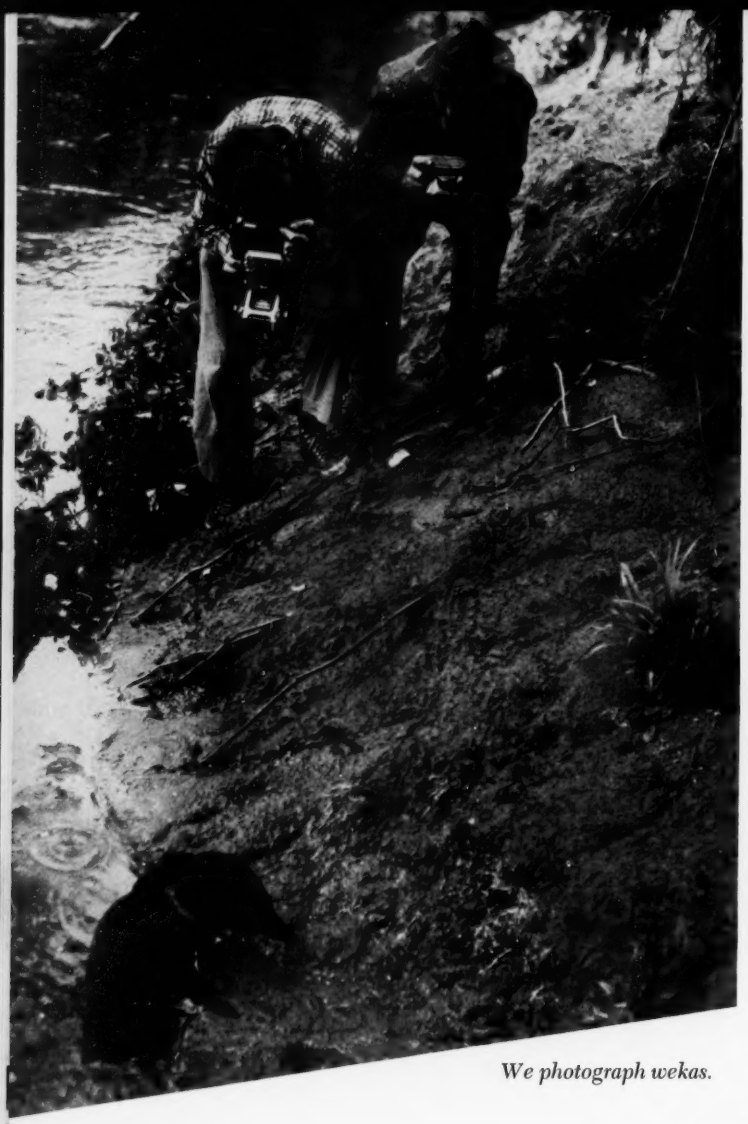
From our base camp on the lower Stillwater River the packers carried supplies and mail to outlying camps, and from here we had radio communication with the outside world.

Mr. Lindsay Poole, botanist and deputy leader of the expedition, undertook to study and to interpret the plant growth of the rain forest.

kind is the food habits and the forage supply of the animal in question. Accurate botanical identification is essential.

But here my own inadequacy was compensated for by my close co-worker, the deputy leader of the scientific party, excellent botanist and coöperative companion, Lindsay Poole, who is head of the Botany Division of the Department of Scientific and Industrial Research. He had been making special studies of the southern beech, *Nothofagus,* and took this opportunity to make extensive botanical collections in the Fiordland. We collected plants, obviously eaten by wapiti, and saved stomach contents of all specimens for later determination by Ruth Mason of the Botany Division, who joined the expedition for a short time to become familiar with field conditions in this area. Moreover, other members of the party knew the flora and contributed to our knowledge of wapiti and red deer food habits.

Something that impressed me particularly, when I actually encountered it in the field, was the reversal of the seasons as I had known them in the northern hemisphere. I think it was early in April that I heard my first red deer "roaring." We had then moved to the camp on the upper Stillwater River. It was after supper, as we busied ourselves about the camp, that the raucous call came down the valley. Red deer had been brought to New Zealand long before the wapiti, and they had moved into Fiordland from adjacent areas. Both the red deer and wapiti had adjusted their breed-



We photograph wekas.

ing period to the appropriate New Zealand autumn—part of March and April.

It was interesting to reflect that from a center of dispersal somewhere in Eurasia the original red deer-wapiti lines had diverged—one going eastward, eventually to reach the North American continent, to become the wapiti or American elk; the other westward to the European countries, to be known as the red deer, Then, in New Zealand, where no land mammals at all were indigenous, man brought these two animals onto the same range. In the Fiordland we heard both "bugling" and "roaring," and could expect to see either red deer or wapiti in a day afield.

One of the difficult problems confronting us was the possibility of hybridization. Stalkers had plenty of observations on mixed herds in the rutting season. They had trophies which they judged to be hybrids. One difficulty in such a study is the extreme variation in antler form in either species, though it must be admitted that stalkers are very close observers of antler types. This question awaits more thorough examination of the specimens we collected.

For a time it was difficult to become adjusted to the experience of seeing the familiar American "elk" in an environment in which one found such exotic forms as the tree ferns, so suggestive of the tropics, the climbing vines and epiphytes, and the whole array of forest tree species so foreign to us from America. And on the mountain heights are the roving bands of keas, the parrots that had departed from the jungle habitat to claim the alpine heights. With the bugling of the elk could be heard the song of the bell bird, and the raucous cry of the weka (wood hen). Against the greenery of a distant hillside we might see the graceful "swan dive" of the New Zealand pigeon.

There were some familiar aspects, too, as we soon realized. The elk had discovered the "tops," as the New Zealanders call the alpine heights above timber line, and found there a type of grassland that served in a fashion as a substitute for our alpine meadows. The snow grass, or tussock, of the genus *Danthonia*, grew luxuriantly on many high slopes and here the wapiti foraged, eating shrubs as well as grass, as they do in America. They also feed in the scrub belt, near timber line, on some of the mountain slopes, and in the river bottoms. But there were no coyotes to serenade us, no bears to be expected. The largest carnivore

The weka (Maori name) is a flightless New Zealand rail. Its short wings have spurs used in fighting. It is reputed to be thievish and mischievous.

Lindsay Poole watches two wapiti stags, while a group of curious keas watch the watcher—one of them hopped over and nipped the scientist in the leg.

in all the Fiordland is the weasel, and few of him.

For me the seasons were chaotic. It seemed normal enough to realize that winter was coming on, but to think it was the first of May seemed incongruous. But winter it was. We had moved over a divide to salt water at George Sound about the middle of April, just ahead of a heavy fall of snow. The Land Survey crew, three hardy men of a hardy country, continued their work for a time on the wintry tops. Then we had our last major move, over Henry's Saddle, down the inland slopes, to the shore of beautiful Lake Te Anau. Our camp one night on Henry's Saddle could have been a winter camp in any high snow country—resplendent white landscape by day, a welcome fire and warm supper in the evening. And it was a comfort eventually to reach the luxurious hut near Lake Te Anau.

Of special interest to me were my New Zealand associates. Ralph Kean and Baughan Wisely, representing the Wild Life Branch of the Department of Internal Affairs, were detailed to assist me directly on observations on wapiti; and the two government hunters, Del Jenkins and Don LeBeau, with amazing skill and woodsmanship, obtained many of the specimens of wapiti and red deer. On the latter part of the expedition Ken Meiers also joined us to help with specimens. And Charles Lindsay, Preparator of the Dominion Museum, took care of the specimens and saw to it

The kea is a native parrot of New Zealand that inhabits the high mountains.

that they were properly handled and shipped out on the boat that called at Caswell Sound every fortnight.

But each of these could double for any other duty that came along. *All* were good hunters and woodsmen. Baughan Wisely, scientific assistant, could carry a pack of supplies with anyone when necessary, and often did so. Many of them were familiar with other fields of inquiry than their own, and it seemed to me everyone was a pretty good botanist.

I learned much from these people, a way of life and an outlook that, while not radically different from ours in America, had certain characteristics that apparently were the outgrowth of a somewhat different culture and environment. Living in companionship day by day, overcoming the same obstacles, enjoying the same beauties and experiences, striving for a common objective, drew us together in a wholesome exchange of ideas and philosophies.

We also had some volunteer help. Kenneth Sutherland and Edward Herrick, both veteran stalkers with experience in Fiordland, offered to study, on their own, two areas which our expedition could not hope to reach. At the conclusion of their private ventures each of them forwarded to me an account of his findings. And throughout the country, after the expedition was finished, people wrote and offered information, or suggestions, on some phase of interest concerning the Fiordland.

The problems caused by introduction of exotic species in New Zealand are well known: the remarkable increase of the introduced red deer and Australian opossum, the European rabbit and hare, the ermine, domestic goats and pigs, the blackberry vines and gorse, and an almost endless list of animals and plants that have become a liability. But in the Fiordland we saw little of this.

Winter in Henry's Saddle.
We might have thought we were in the Rockies or the Sierra Nevada—until we looked at the calendar.

This is how the Fiordland country looked from Henry's Saddle—deep canyons, lofty ranges.

To be sure, there were the exotic wapiti and red deer, the principal objects of our study. But these had not reached excessive population levels and other exotics were either absent or scarce. Fiordland is pretty much still New Zealand.

As we look back on this experience we realize that for us, personally, it was not all wapiti. It was parts of many things—long dreary rainy spells, when the water spilled off the mountain tops in silvery streams and the water rose in the river and overflowed the banks. There were the ever green forests, carpeted with moss and other herbage, draped with mosses and ferns and lichens and hanging vines. We became acquainted with the engaging little New Zealand birds and gained the delight of recognizing them. At night we sometimes heard the kiwi. Mostly it was a vast wilderness, a country little touched by man. A member of the party found three Maori adzes on Lake Marchant, which took us into the historic realm of those early discoverers of this green land.

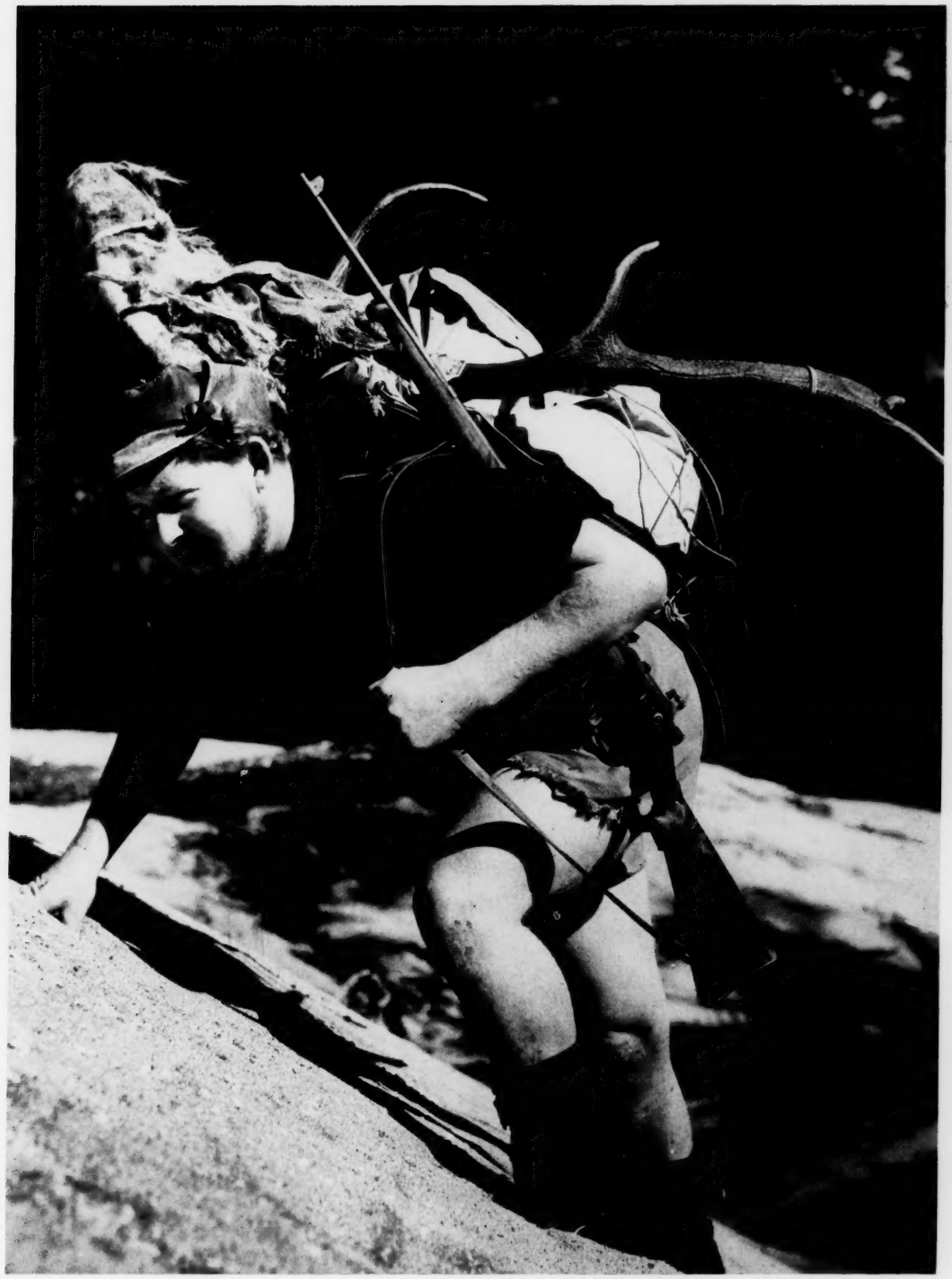
The Fiordland is a national park. New Zealand has been awake to the need for such provisions and has established many national parks and nature preserves. Fiordland National Park will no doubt always be a wilderness park. One can coast along the outer fiords by boat. There are comfortable quarters at Milford Sound, in outstanding scenery. There are excursions on picturesque Lake Te Anau, from the settlement of Te Anau. There are accommodations at Manapouri, nearby. All of these touch on the borders of the Fiordland wilderness, giving access to it. But the rugged interior

will be for the hardy adventurers who will take their outdoor recreation spiced with physical exertion and a tussle with the elements. The rewards are great—satisfaction of personal achievement; appreciation of a special kind of forest environment; hearing the bell bird in original setting, as the first Maoris must have heard it; coming up on the confiding blue ducks on the mountain streams (as we sometimes find the harlequin ducks in our mountains); or it may be a pair of paradise ducks grazing on a grassy "lawn" on the shore of Lake Marchant, in an incomparable setting of wild towering mountains. And, like special jewels of great luster, there were the welcome sunny days on the tops, lounging on a slope of snow grass, with perhaps a social group of keas to keep you company.

Perhaps I have not touched on the real drawing force. Perhaps there is something not yet clearly understood, that something that stirs those old-time stalkers to go back again and again, men advanced in years, men who have seen the country many times, who have cursed the rain and the sand flies. They want to go back to Fiordland. Such were our coöperators, Ken Sutherland and Edward Herrick, who didn't want to be left out when the Fiordland was being explored.

If I were to be granted wishes for the people of New Zealand, I think I would wish that a century from now the New Zealand culture will still have its present-day vitality; that the people will have borrowed from other cultures only the strong, worthwhile ingredients; that there will still be those who have the exuberance and will to enter the bush, the native wilderness, with the ability to endure and to appreciate—people like those who today can experience a nostalgic urge to go back and try the Fiordland again. END

New Zealand's blue duck has lead-blue plumage.

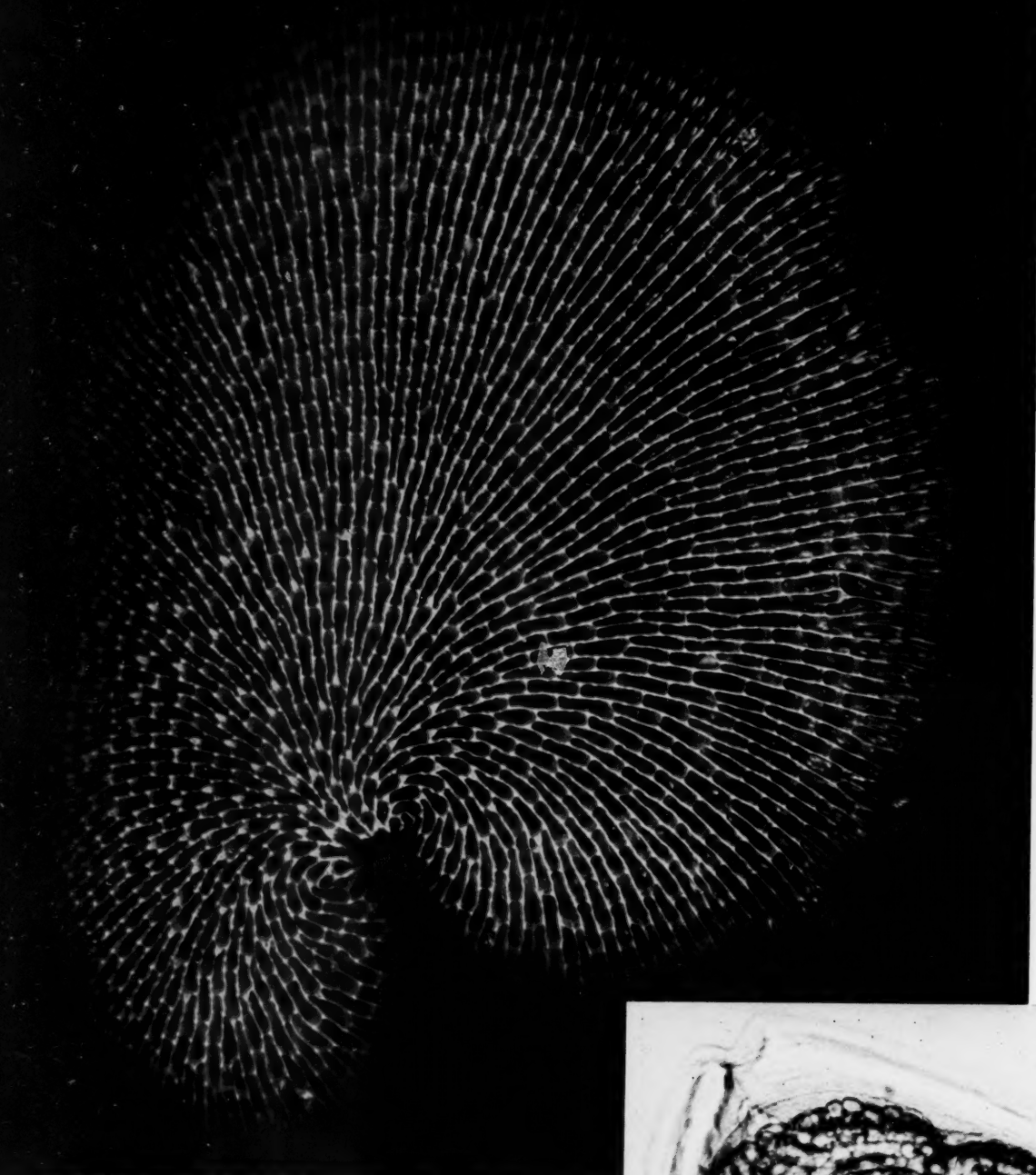


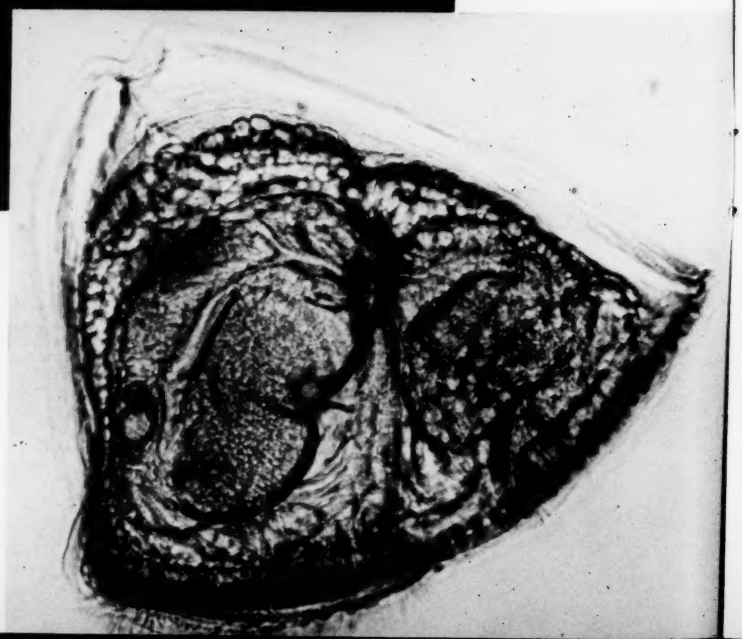
Mr. Del Jenkins, experienced deer shooter,
was one of those who collected wapiti and red deer, and
packed the heavy specimens back to camp.

CYPHONAUTES:

Story and photographs by
M. WOODBRIDGE
WILLIAMS

The larva settles and buds off new individuals that develop tiny calcareous shells. The colony grows to form lacework on fronds of kelp, on rocks, and other surfaces. Male and female sex organs are present in the same individual, producing the free-swimming larvae, cyphonautes, that leave the home base to start new colonies.





➔ *The marine plankton off the California coast is enriched by minute larval animals whose triangular bivalve shells are clearly defined under the microscope. The adductor muscle is left center; just to the right is the gut. Along the base can be seen the cilia that propel the animal by beating the water.*

The Bent Sailor

THE SEA SWARMS with microscopic larvae which are destined to perish in the waves or to find a solid surface to settle upon and, in changed form, decorate with exquisite filigree. One of the most striking of these almost magical transformations occurs among the Bryozoa.

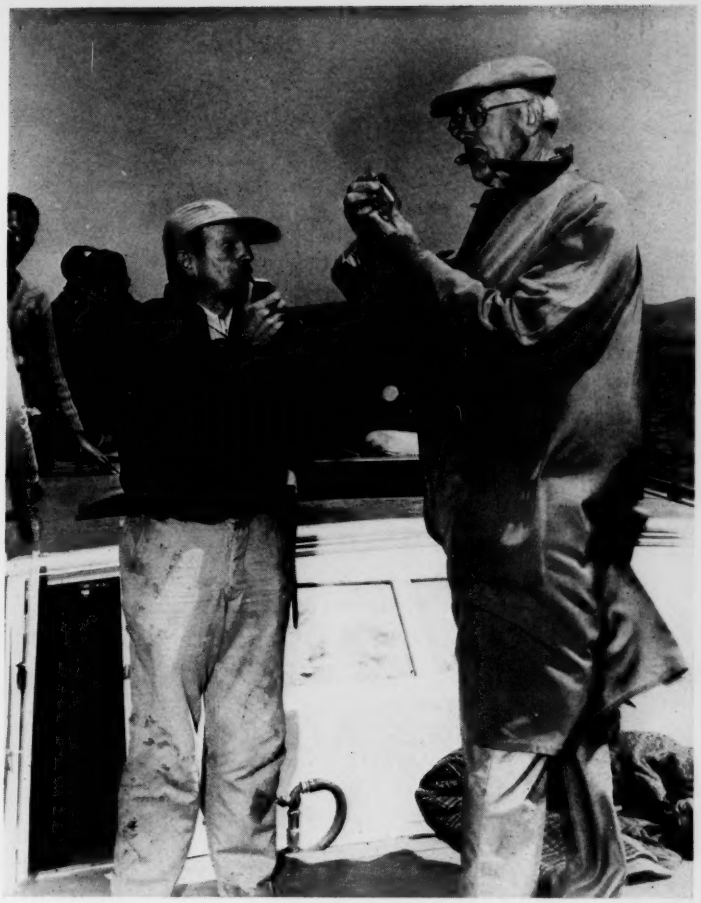
Most larval bryozoans are simple ciliated creatures, but the larva of the genus *Membranipora* achieves a more complex form (as our photograph shows). It is encased in a bivalve shell operated by an adductor muscle. Surrounding the mouth are numerous little "whips"—flagella—that propel the creature through the water, and perhaps bring food to its mouth. So unlike the adult is it, this larva was originally described as a new genus of pelagic organisms, called *Cyphonautes* (from two Greek words meaning "bent or humpbacked" and "sailor"). Later, science had one of its moments of taxonomic embarrassment—it found the young sailor bent on making fast to anything handy, taking to a completely sedentary life as a colonial encrusting bryozoan.

If left undisturbed by man and not engulfed by some larger predator, the cyphonautes, as a bryozoan larva is now called, will settle upon a hard surface, even a piece of seaweed or driftwood, and begin to bud off new individuals quite unlike itself. The free-swimming infant of the plankton becomes a fixed colonial form; the closely packed and joined bryozoans in mass often make a pattern of great beauty.

Instead of a bivalve shell, each new member of the *Membranipora* colony constructs a calcareous cell about itself, often similar in shape to the cells of a honeycomb. Other genera build horny, membranous, or sometimes gelatinous structures. The mode of division varies, so that some bryozoan species are flat encrusting forms, some are tubular, some foliose; some are like tufts of the most delicate seaweeds. They vary much in the manner of different types of lichens.

The name "Bryozoa" is derived from their semblance to the lower plants. It means "moss animals" and it has been suggested that many bryozoans make better seaweed specimens than the seaweeds themselves! Yet some of the most striking forms on the Pacific Coast look more like delicate corals. It takes a microscope to make out easily the distinguishing structural differences.

A typical bryozoan has a retractile group of ciliated tentacles about the mouth, but instead of being distributed radially as in the coelenterates, the moss animal's tentacles are twisted or looped to form a "lophophore." Instead of a sack-like gut such as the coral animal's, the bryozoan has a mouth, intestine, and anus. This digestive tract forms a **U** so that the anus is close to the mouth in the same plane, but usually outside the lophophore.



Many of the branching bryozoans resemble hydroids, another group of plant-like animals, of the phylum Coelenterata. Again, microscopic examination will reveal that the flower-shaped animals of a hydroid colony are joined in a common gut, or cavity, while each bryozoan is a complete animal.

While biologists have left the Coelenterata on the main track of animal evolution, they have shunted the Bryozoa to a siding—not knowing what else to do with them—along with other perplexing groups, such as the lamp shells or brachiopods. These animals of ancient lineage resemble a clam, but differ in having a lophophore. They have sometimes been placed in the same phylum with the Bryozoa.

Both these groups have existed for several million years, since the early Ordovician period. Their skeletons have made an excellent fossil record of the long stay on earth of the two groups. Even today the Bryozoa are one of the most abundant, if not the most conspicuous, of forms living on the seashore. It is hard to imagine that their delicate skeletons are the work of extremely simple animals, or that the inhabitants of them spent their early life enjoying freedom of the seas. END

ABOVE, RIGHT: *Bryozoan expert, Dr. Raymond C. Osburn of the Allan Hancock Foundation scrutinizes a specimen dredged up from Tomales Bay a few miles north of the Golden Gate. Joel Hedgpeth, of the University of California, and pipe quietly await the verdict. The two marine biologists are aboard the* Bios Pacifica, *research vessel of the College of the Pacific which operates a marine biological station at Dillons Beach.*

PEYTON MONCURE

YELLOWSTONE

When the words "Yellowstone Park" are mentioned some people automatically think of geysers; others think of just "Old Faithful." Then there are the artistic-minded who think first of the Grand Canyon of the Yellowstone and its falls. The sportsmen usually think first of the unexcelled trout fishing on every hand.

As for me, when I think of Yellowstone Park I think of bears; and when I think of bears I automatically think of Yellowstone Park.

Yellowstone has 'em—560 of them by a recent official estimate, including 200 grizzlies and 360 black. The black species, incidentally, includes the brown and cinnamon, which are merely color variations.

The Park bears usually go into hibernation the last of October or first part of November. In January the cubs—from one to four, but usually two—are born, weighing from 12 to 16 ounces for the black species, and about one and a half pounds for the grizzlies.

In May and June the cubs may be seen with their mothers along the Park highways, begging for food handouts from tourists. At this time they are tiny, cute, playful, and exceedingly photogenic. Imagine animated, fluffy teddy bears wrestling, sparring, rolling, climbing, and you have

TONE'S BEGGAR BEARS

the young bear cub as he tirelessly and unconsciously performs.

The apparent friendliness of the Park's beggar bears tempts visitors to tease them and get too familiar with them, forgetting that they are actually untamed, wild animals who are occasionally given to temperamental behavior. There have been many hands and arms bitten and scratched by too-trusting motorists who have stopped to play with these roadside beggars by tantalizing them with food held high so they will have to stand on their hind legs to reach the morsel (the bear may take your hand for part of the handout); or by such foolhardy stunts as photographing Junior sitting on bruin's back (it's actually been tried more than once).

Heed the signs along the roadsides which warn against molesting the bears. By taking this advice you may be saving yourself or some fellow tourist a painful accident. Appreciate and photograph the bears from a safe distance. *Don't feed them!* And in camp, be sure to stow all food except canned goods in bear-proof lockers, especially ham, bacon, and other meats. Don't ever hide such items in your tent! The rangers can tell you about the camper who hid a side of bacon under his pillow one night. . . . END

AUTHOR'S PHOTOS

Do people amuse bears as much as bears amuse people? That's a question for the students of animal psychology; but we do know these clowns have an insatiable curiosity which sometimes gets the better of their natural caution. They have, moreover, a talent for "working" the public through the guile of their apparently harmless buffoonery. It's a confidence game— don't fall for it!

GROVES OF STONE: Fossil Forests of t

FOSSIL WOOD IS USUALLY FOUND as prostrate logs and broken pieces or as float. The famous Petrified Forest National Monument near Holbrook, Arizona, is the best-known deposit of this sort. There the trees lie on the ground, exposed by the slow erosion of the sandstones and shales of an ancient river delta into which their water-soaked forms sank several million years ago.

In the fossil forests of the Yellowstone region we see a striking difference. Here most of the trees stand upright, just as they grew before a volcano blasted and buried them. Often the fossil stumps are hard to distinguish from the remains of lately living trees until closely inspected. Perhaps more nearly than any other example, a fossil tree deposit in the Yellowstone matches the concept "petrified forest."

With but one exception the fossil forests of Yellowstone National Park are either far from roads or reached only by difficult climbs. This is for the best, perhaps, when we think of that one area easily accessible to the public, near Tower Falls. On a grassy hillside behind Camp Roosevelt stands a solitary petrified tree, a 12-foot stump—completely surrounded by a high iron fence. In the immediate vicinity there were originally twelve other, smaller stumps. Souvenir hunters ravaged these. They pried, pounded, and chipped at them until, today, not a single vestige remains above the ground. This vandalism forced the Park Service to fence the remaining tree in the hope of preserving it for decent visitors to enjoy.

What made the fossil forests?

The fossil forests of the Yellowstone region were buried during the Miocene epoch by a series of eruptions from a volcanic vent presumed to have been some distance to the northeast of the present park. As the climate changed during the Miocene a variety of trees lived in this region (but probably not all at the same time)—redwood, oak, pine, buckthorn, laurel, bay, sycamore, and even magnolia. Of the trees found fossilized, however, 95 per cent belong to the conifer group.

We can read in the rocks how these successive forests came to be buried. An eruption of the active volcanic vent hurled enormous quantities of mud, ash, and sharp, angular rock fragments high into the air, to rain down upon the landscape and its currently prevailing forest. As the heavier fragments fell they snapped off branches, and the weight of accumulating finer debris broke off others. Only the bare standing trunks were left, to be engulfed by the showers of ejecta like the litter of limbs and leaves on the ground. When the volcanic rumbling ceased, there instead of green forest was an arid, barren plain stirred only by hot winds drifting the newly fallen ash. Here and there, perhaps, a snag broke the desolate surface, reminder of the buried forest beneath.

During the following years rains and snows saturated the new ground and topsoil began to form. Winds carried seeds to this region and soon a new flora had taken root, to flourish until a recurrence of volcanic activity buried it in turn. Meanwhile the pressure of the huge weight of

Yellowstone's best-known "Petrified Tree" near Tower Falls, which had to be fenced in to protect it from souvenir hunters.

WILLIAM B. SANBORN

of the Yellowstone Region

material was consolidating the ash, mud, and rock fragments into breccia. The fineness of the ash and mud prevented air from reaching and decaying the bodies of the buried trees. In their rock tombs the trees went through the slow process of petrification as each minute cell of their structure was replaced by a hard, grayish silica carried in solution by percolating waters.

How many times this cycle was completed no one knows, nor do we know how many generations of trees existed upon any one landscape before it was buried by a new eruption. Erosion has enabled us to learn what we do know. In many sections of the Yellowstone region deep canyons and valleys have been cut down through these ancient tree-bearing strata. As the softer rock around the trees is slowly stripped away by erosion the trunks are left standing erect upon lofty ledges in sheer cliffs, on hillsides, and on tops of ridges. Such exposures are like great textbooks with open pages, for we can often see ten to twenty-one separate levels of fossil forests, one above the other. So far no vertebrate remains have been found in association with the trees.

Contrary to popular opinion, the forests are not limited to Yellowstone National Park but occur widely beyond the northern boundary. The greatest concentration of reasonably accessible trees is within the park, however. The entire northeast and northwest portions of the park are studded with tree-bearing strata. During my years as a park ranger naturalist I have visited the main localities within the park. A growing interest has led me into much exploration of fossil forest regions outside the park and, by luck, the discovery of some major areas. But first, it would be well to describe the best known localities within Yellowstone Park itself.

Specimen Ridge, Amethyst Peak

If there had been no geysers in the Yellowstone, no hot springs, lakes, and many-colored canyons, the fossil forests of Specimen Ridge alone undoubtedly would have given the area park or monument stature. Here is the park's most concentrated display of fossilized wood—often illustrated in geology texts and general science books.

This is one of the first fossil stumps you reach as you climb up Specimen Ridge.

Specimen Ridge follows the southwest side of the Lamar Valley in the northeast section of the park for about ten miles. The entrance highway into the park from Cooke City, Montana, passes by most of the formation which lies across the Lamar River from the road. Opposite the Buffalo Ranch is an escarpment in which eight levels of trees may easily be distinguished by eye alone, and about twelve with binoculars. Many trees stand in this cliff face—it has often been said—like columns of some ruined temple. A trail leads into the forest but the Lamar River must be forded, a cold job even in midsummer. The ambitious may follow the trail for a few miles to the top of Amethyst Peak, highest point on the ridge. As one climbs, pages of the past open to the eye. Fossil trees are within 500 feet of the summit of the peak which is 2,000 feet above the Lamar River. On one such climb we counted twenty-one levels, though faulting may have taken place in this sec-

Redwoods lived in the Yellowstone ages ago; this stump is on Specimen Ridge.

tion of the ridge to make the tally doubtful. Bighorn mountain sheep frequent these crags and rocky slopes.

Amethyst Peak was so named—visitors often ask this—because trees containing cavities lined with amethyst crystals were found on Specimen Ridge years ago. When the area became a national park the collecting of any sort of specimens was forbidden (such measures are rigidly enforced).

The northwestern end of Specimen Ridge has the most photogenic trees where the forested appearance of the ridge is broken sharply by a series of sheer rock walls. In the highest stratum exposed stands a splendid group of fossil trees. First glance towards the area from the highway may indicate a short, easy jaunt. Nevertheless, one should plan for a day's trip—distance and difficulty are deceiving. Easiest ascent is by any one of the numerous game trails at the base of the slopes. They lead up to a small spur ridge and follow its crest until it joins the main ridge. Once on the spur's crest, we see stumps of fossil trees. They run from one to four feet in diameter, seldom protruding more than two or three feet above ground.

Nearing the main body of Specimen Ridge, we enter a grove of white-bark pine and Douglas fir, and suddenly burst into the open at the top of a sharply sloping cliff face. Directly in front of us, the stump of an enormous redwood clings to the rock wall by its roots. Its six- or seven-foot diameter suggests, by comparison with living redwoods, a tree more than 200 feet tall. Below this stump and on a different level are two pines that belonged to an older forest than the redwood. Each stands about 15 feet and shows a complete root system. Immediately below this pair stands a third pine, a 12-foot stump, on an older and lower level. The "wood" is dull, brown and grayish; lichens usually encrusting the stumps are startlingly suggestive of decaying, recently living trees. As we clamber around on the rubble and talus of the rock slopes and explore the ravine in front of the cliff, dozens of trees appear. Erosion-shattered fragments and larger sections of trees are scattered about in profusion. Some levels contain only occasional specimens, a few have none at all, and others show evidence of a very dense forest. There are also levels in which almost all

the trees are prostrate, witness perhaps to the force of an ancient eruption or windstorm. In an area less than one quarter-mile square, we counted 15 individual stumps or logs.

Besides petrified trees, we may easily find on Specimen Ridge myriads of leaf and fern imprints in the shales that also comprise parts of the strata. Over 150 different plant species have been identified from such imprints. Their living wild flower successors covering the slopes of the ridge bring present beauty during the summer. Lupine, butter'n'eggs, phlox, cinquefoil, geranium, balsamroot, forget-me-not, phacelia, and the exquisite bitterroot are just a few of the commoner kinds.

There is animal life here, too—I know from experience. Engrossed, one time, in photographing a group of tiny fossil twigs far up on the ridge from the forest just discussed, I heard a pounding, and glanced up. Coming down the ridge towards me, throttle wide open, was an old bull bison. Light meter and Leica streaming out behind, I hit a pace, down the ridge towards a clump of fir, that was remarkable for a fellow who'd never shown much interest in track! Seeing me safe in the fir-mat, the old bull stopped short at the 50-yard line, pawed and snorted a few times while weaving his massive head back and forth. Finally, assured he'd vanquished the intruder, he trotted nonchalantly over a rise in the direction of the Yellowstone River. Bison will let you alone, as a rule, if you do the same by them; but old bulls that have been cast out of the herd can be very antagonistic.

The Gallatin forests

The wilderness area in the northwest corner of Yellowstone is one of the park's least visited sections. This area includes the bulk of the Gallatin Mountains and falls in Wyoming and Montana. The Montana part abounds in fossil wood but it is hard to reach the areas with the most interesting petrified trees. The headwaters of Daly and Specimen creeks are in the heart of thick beds of wood-bearing strata comparable to Specimen Ridge. The country is remote; it takes a hike of ten miles or more to see good trees—most of it *up*. There are many standing trees in this section, which is larger in area than Specimen Ridge proper, but the main attraction is the great size of some of the stumps.

In 1948, my wife and I made the ascent with another couple into one of the Gallatin forests. We found one stump, probably a redwood, over 18 feet in diameter but protruding only ten inches above ground. Several large stumps such as this barely stuck out of the earth on the bleak, high, wind-swept ridges of this area.

The Park Service knows very little about the fossil trees in the Gallatins and my experience in this region would indicate that it may not be feasible to open it up with trails. Few visitors make the climbs up Specimen Ridge; the Gallatins are much more difficult. Their fossil forests are accessible only by long treks; the area is vast, the terrain rugged, the best trees widely scattered and hard to find.

Minor concentrations and occurrences of fossil trees are to be found in many sections of the park. Within a radius of one or two miles from the fenced Petrified Tree, near Tower Falls, one is likely to come across stumps and logs. Most of the accessible ones, it is shameful to admit, have suffered heavily fron vandalism. The entire northeast section of the park contains many localities, especially near the headwaters of Slough, Cache,

One of these two fossil pines on Specimen Ridge shows a very well developed root system.

and Miller creeks and on the high, precipitous slopes of The Thunderer, Abiathar and Baronett peaks, and on Mt. Norris. The western slopes of the Absaroka Mountains that border Yellowstone Park on the east bear some fossils. There is a notable concentration some 20 miles northeast of Fishing Bridge around Pelican Cone. Along the shores of Lake Yellowstone water-worn pebbles of petrified wood are not uncommon, and in the Yellowstone River occasional boulders of wood may be seen. One should look in road cuts for evidence of fossil trees, especially around Lake Butte on the east gate road to Cody.

Cedar Creek Forest

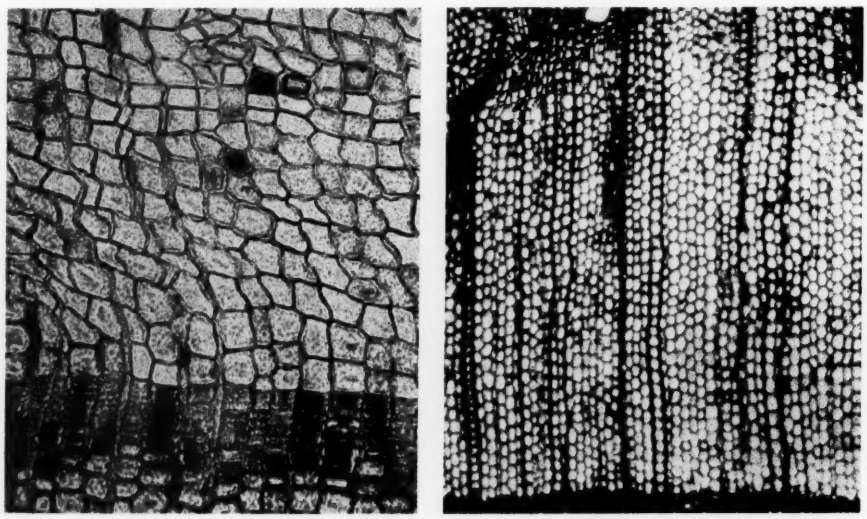
My interest in tracing other tree localities outside park limits was stimulated one day when I was talking to Johnny Hepburn, an old timer in the Yellowstone Valley. He remembered a group of trees above an old dude ranch on Cedar Creek and said that wranglers used to guide visitors up there to show them the "petetrified" trees. Getting directions, I made two successive trips into that area in 1947, accompanied by Frank Rentchler, another naturalist.

Cedar Creek tumbles down from the lofty Beartooth Mountains about 15 miles north of Gardiner, Montana. A dirt road that does its best to defy low gear winds up a series of hills and drops into a beautiful valley where the old ranch is. On all sides tower the snow-capped Beartooths. One glance at the formations north of the ranch told where the trees were—we saw the layer upon layer of volcanic material.

As in the park, it took a long uphill climb to reach the forest strata. We found only a few fossil trees standing; most were prostrate. Only five levels could we trace clearly. A few of the trees were well agatized and colored in comparison with the familiar gray and brown. We were interested in several large redwoods, poorly silicified, that had been eroded out of the cliffs, leaving behind great tunnel-like openings. One such "tree cave" had a diameter of about 15 feet; we went back into the mountain several yards before we reached the crumbling Miocene wood. A survey of the surrounding country from the top of the formations disclosed prolific outcroppings of the strata extending for several miles to the east and forming a huge amphitheater to the north at the head of Slip'n'Slide Creek. All the strata we examined contained wood, and in the Slip'n'Slide Creek area many logs were beautifully opalized.

Discovery in the Tom Miner Basin

The finds around Cedar Creek spurred us to trace down rumors of forests in the back country of the remote Tom Miner Basin in the northern part of the Gallatin Mountains well beyond park boundaries. This region is at the far western end of the Yellowstone Valley about 25 miles north of the park line in Montana. A small settlement



Wood cells in perfect detail may be studied through the microscope in thin, translucent sections cut from fragments of petrified trees. This enables paleobotanists to determine their relationship to other species, living and extinct.
LEFT: *Redwood* (Sequoia magnifica) *magnified 120 times.*
RIGHT: *Pine* (Pinus baumani) *magnified 75 times (transverse sections).*
(From Fossil Floras of Yellowstone National Park and Southeastern Oregon, *Part I, by Charles B. Read. Publication No. 416, Carnegie Institution of Washington, 1933)*

Fossil-bearing strata rim aspen-girt meadows in the Tom Miner Basin.

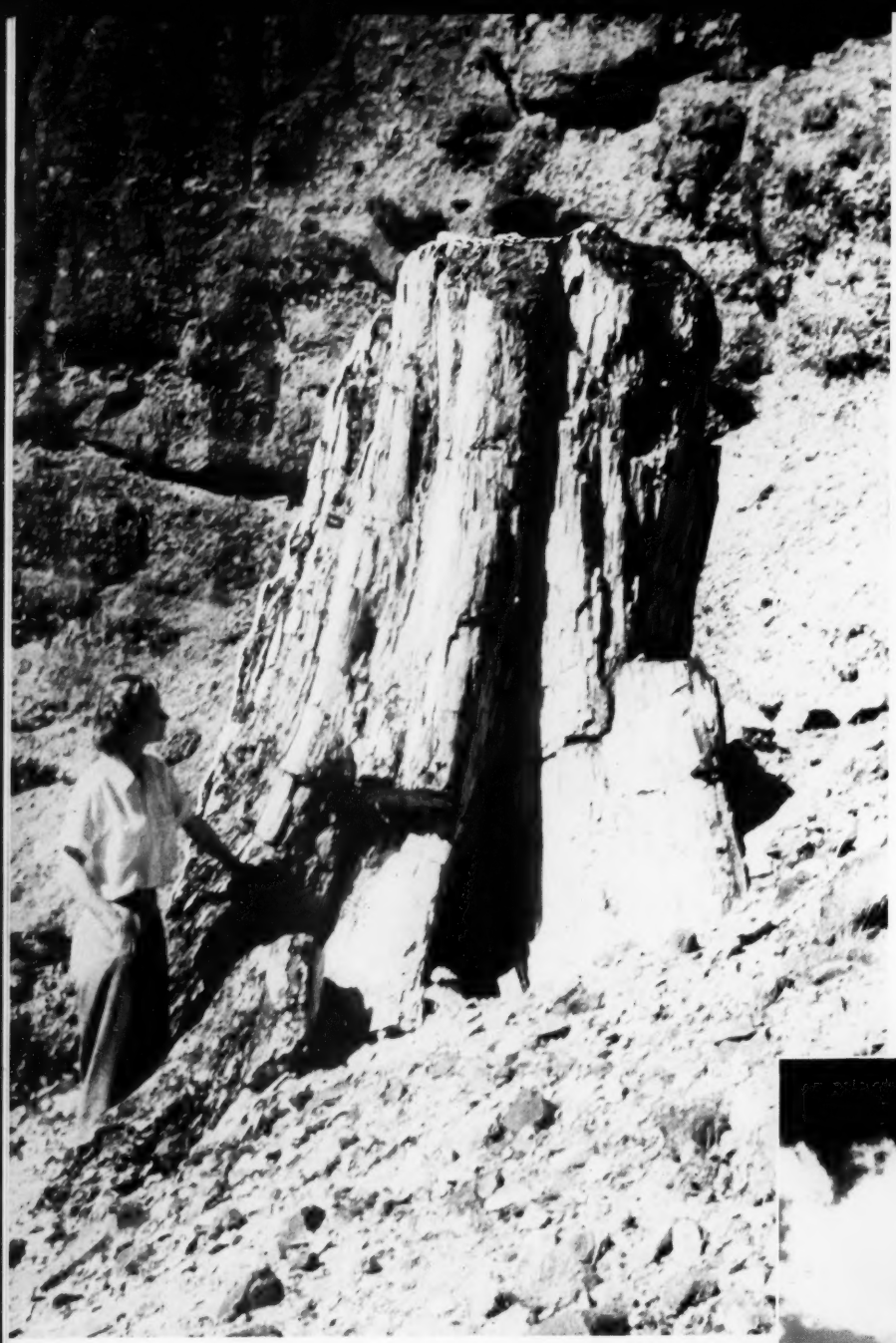
called Carabella nestles at the mouth of the basin and is notable for high-quality hay farms.

Helpful ranchers directed us to places where they had found specimens or had heard of others finding them. Two trips into the back country yielded little more than stream pebbles of wood, but this was enough to indicate that somewhere in the surrounding snow-capped mountains there were fossil trees. Our third trip carried us into the western end of the basin where great cliffs rise hundreds of feet. In some of these we were rewarded by the sight of a few standing trees. But they were altogether impossible to reach, many being four or five hundred feet up in sheer cliffs.

Our fourth trip, late in August, took us still farther into the back country. We followed an old ranch road to its end and finally hiked for several miles. The country was very beautiful. Ice cold streams were common; the tall stands of fir and spruce comprising the main forest cover were liberally sprinkled with shimmering groves of quaking aspen. As we hiked, my wife, Joan, spied an outcropping of high ledges on our right that looked like good prospects. An hour's climb brought us to the first of the formations. Wood was there. Several small stumps protruded from the breccia which looked just like the material in Yellowstone Park. Climbing up through the different levels, we were amazed at the coloring of the wood. Much of it was jasperized with bright green and reds with stringers of clear chalcedony running through it. It was a fine reward for really tough climbing.

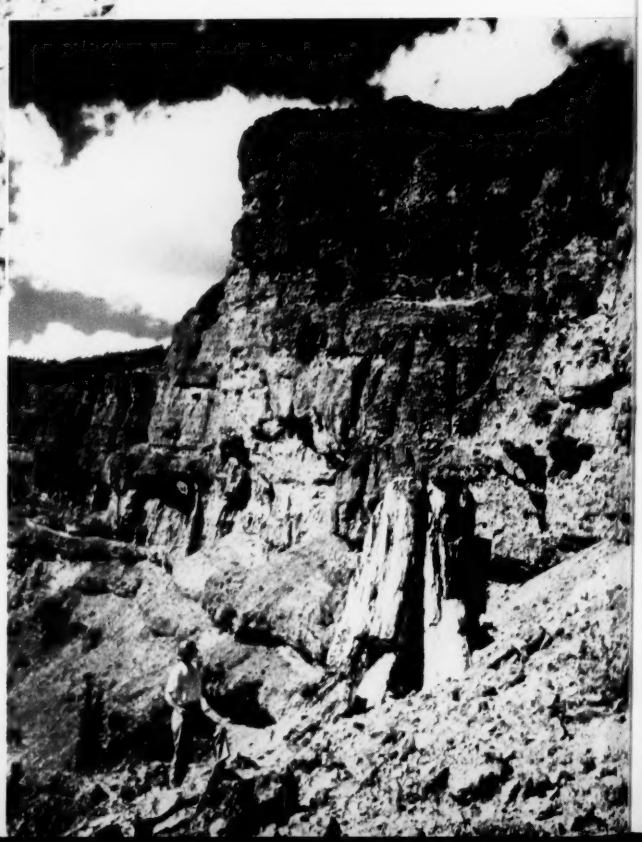
Interspersed between levels in the breccia were thin gray-blue beds, probably fine volcanic ash. Probing the talus from these deposits, we found the material literally full of leaf imprints. The commonest was a delicate little redwood-like frond.

After inspecting several small fossil trees we spotted a gnarled white-bark pine clinging to one of the levels above us and decided to lunch in its



Photographs by the Author

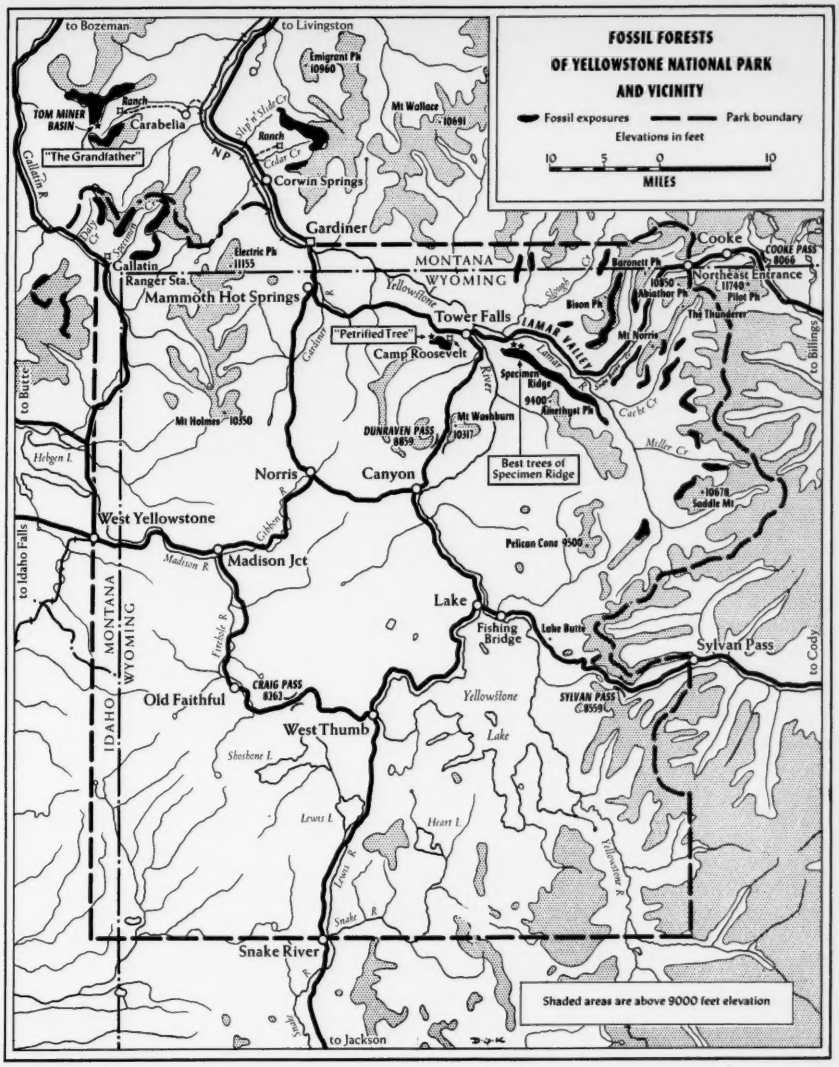
The author's wife, Joan, takes the measure of "The Grandfather"—he cut a fine figure of a tree in his Miocene youth (some paleobotanists consider these forests older than Miocene). The view below is a close-up of part of the cliffs of the panorama on the preceding page. As the drainage system of the basin gradually erodes the sides, rank after rank of stone trees takes its place, perhaps for a few thousand years, at the "edge of the forest"—supporting columns on the walls of a gigantic amphitheater. When the encasing breccia crumbles away, the stone boles finally topple down to the talus slopes below the cliffs.



shade. We scrambled up to it by the boost-and-push method, and landed atop a buttress that ran out from the main cliff formation. To our surprise the strata extended up a deep canyon to the north for over a mile and in the distance beyond we saw still other outcroppings. In many places we easily made out the fossil trees.

When we looked at the cliff face behind us we got the greatest thrill of our entire experience among the fossil forests of this region. Not more than a few paces away from us stood the largest fossil tree we had ever seen. Its lichen - encrusted form stood close to 12 feet high on the north side and had a diameter of nearly eight feet where its base went into the rock. Although this tree was not as tall as some on Specimen Ridge and lacked the diameter of some of the fragmental stumps of the Daly Creek area, it still had just enough of each dimension to make it the most spectacular petrified tree of our experience. Probably a redwood, it was quite elliptical in section. It had been eroded considerably and several inches were gone from its original diameter. We named it "The Grandfather" in the belief that it would stand for some time to come as king of the fossil trees of this region.

Exploring these exposures proved fascinating though fairly arduous. The surprising variety of beautifully crystallized minerals associated with the fossil logs was perhaps the most noteworthy attribute of this locality. The centers of the logs were often hollow and in some we found huge saddle-shaped crystals of dolomite, some coated with an exquisite hyalite opal. Barite, aragonite, fluorite, and calcite were also found well crystallized in the logs. Several logs were actually great geodes, their centers completely lined with quartz crystals. One such log stood upright in the rock, forming the roof of a cave the wind had undercut into the cliff at its base. The log, three feet in diameter, had a two-inch hollow completely lined, as we saw looking up, with drusy quartz crystals. Near-by we picked up a small log section lined with clear amethyst crystals. Agate and jasper of many colors marked the wood. On one level practically all the logs had been completely replaced by chalcedony. Here, too, blue chalcedony had entirely filled the molds left by decayed small limbs and twigs.



This map was compiled and drawn by the editor, with fossil data furnished by the author.

It was late afternoon when we had to end our exploring. Cold wind and growing cumulus to the west warned of a coming storm. We looked at "The Grandfather" again, then began the long trip down from the rocky heights and back to the car. We left the Tom Miner Basin fully realizing that, however much we'd seen, we had just scratched the surface of a vast, never fully explored region. It's still there for any one with the time and the urge for this kind of adventuring into some of our last wilderness. END

HOWARD HINDE

JUNGLE GHOST-TOWN

HALF-COVERED BY THE ENCROACHING JUNGLE, its lifeless windows staring out into the blue brilliance of the Pacific, Panamá Viejo stands in ruins today, a monument to much that was folly and something that was great among the Spanish *conquistadores.* As one walks in the sun through the silent stone skeletons, it is difficult to realize they once were a part of the greatest metropolis of the New World.

Old Panama was originally a small but prosperous fishing village where Indians had lived for an unrecorded length of time. In the year of the white man, 1515, however, the Captains Diego de Albites and Antonio Tello de Guzman stopped there on their search for a golden treasure which, it had been whispered, was to be found along the west coast of the Isthmus. Although the Spaniards did not find gold, they did decide that the village of Panama was an ideal spot for the southernmost of their trading stations, a string of which laced the Isthmus.

In 1519 Don Pedro Arias de Avila, "The Cruel," formally founded the town, the first white settlement on the Pacific Coast of the Americas. Its growth was rapid. Almost overnight, it developed into the richest and mightiest city of the Western Hemisphere. Through it passed all of the riches of Central and South America, and of the Orient. Gold and silver bullion from Peru, oriental spices, perfumes and jewels, pearls of fabulous beauty from the Pearl Islands—all were brought into Panama. From there they were carried across the Las Cruces Trail to Nombre de Dios or Porto Bello, where they were loaded into waiting galleons and sent to the coffers of the King of Spain.

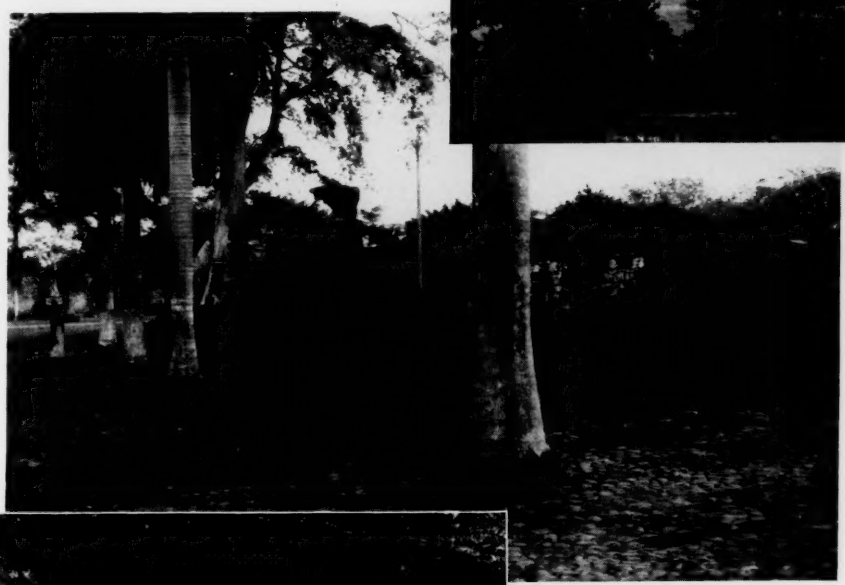
Tales of Panama's beauty, the wealth of its Spanish aristocracy, the loveliness of its women, the treasure hidden behind the walls of its homes and churches, spread far and wide. At last, they reached the ears of Henry Morgan, the cruelest, most widely-feared pirate on the Spanish Main.

Morgan had taken every port of consequence along the Caribbean shore, but none was so tantalizing as the fabled Panama. It would be a bold stroke, indeed, to take the city, protected as it was by the fever-ridden jungles which stretched from its gates to the Caribbean. But Morgan's boldness knew no bounds. Nothing was impossible to him. He undertook without hesitation the expedition which has come down in history as the most shocking example of wanton destruction the America's have ever known.

On January 18, 1671, having subdued the Fort of San Lorenzo, Henry Morgan began his ascent of the Chagres River with 1,400 men and the equipment of war loaded into seven ships and 36

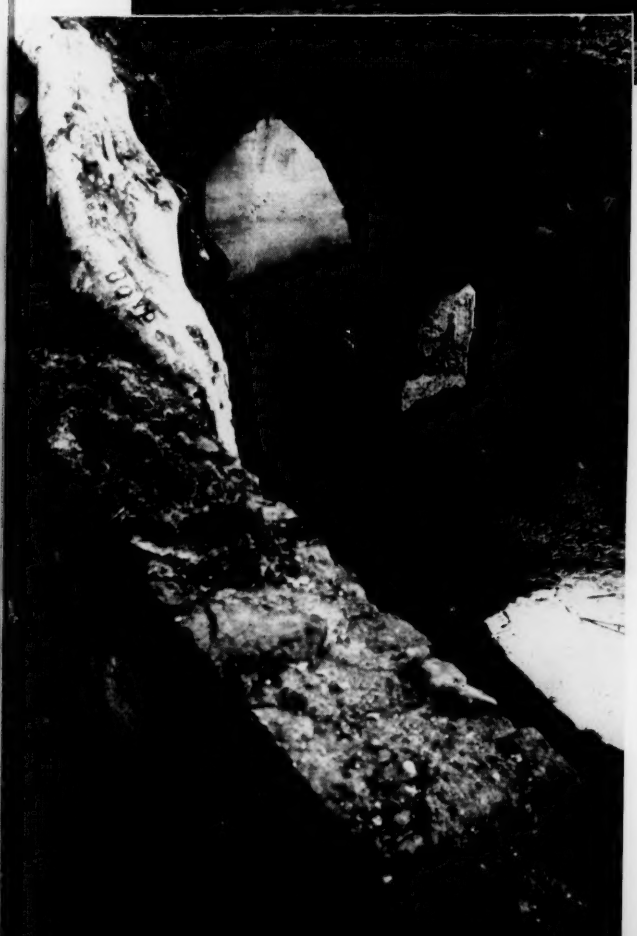
Henry Morgan—
most terrible name on the Spanish Main!
Ruined Panamá Viejo bears grim witness
to his greedy lust

← *Ruins of San Jose Convent in Pamamá Viejo. (Ministry of Agriculture and Commerce, Republic of Panama)*



↑ *Tower of the cathedral, Panamá Viejo. (Ministry of Agriculture and Commerce, Republic of Panama)*

← *Broken columns and a crumbling shell of masonry stand beside a cobblestone street that has been deserted for three hundred years. (Author's photo)*



boats. He carried few provisions, for it was his intention to live off the land, pillaging Indian villages along the route. Both Indians and Spaniards had heard of his approach, however, and had fled before him, scorching the earth behind them. The Chagres was against him too, for it was the dry season and the water was low over the many snags and sand bars. Morgan was soon forced to abandon his ships and boats and take to the overland route, the Las Cruces trail.

Their meager food supply soon gave out, and the buccaneers were reduced to eating leather, dogs, cats, roots—anything they could lay their hands on, and there was not enough to support them. Weakened by starvation, the pirates struggled on, harassed occasionally by bands of Indians whose wild cry, *"A la savana!"*—to the savannah!—taunted them.

The Spaniards from Panama made no attempt to stop Morgan's approach. They could have

Strangler fig roots clutch the mossy stones of the subterranean dungeons where the rising tide drowned Panamá Viejo's political prisoners. (Author's photo)

averted the terrible disaster had they but tackled the starving pirates along the jungle trail. Instead, they remained behind the walls of their doomed city and prepared to defend it. And so it was that in the late afternoon of January 2, 1671, Morgan climbed to a hill overlooking the broad savannah which stretched across to the city gates. There below him, grazing peacefully on the rich pastureland, was a wealth of cattle, left either by mistake or because of indifference among the Panamanians. Whooping with joy, the buccaneers dashed down onto the grasslands, killing the cattle with wild abandon. Carving out great chunks of the still-quivering flesh, they stuffed themselves gluttonously. After the edge of their hunger was dulled, they dug deep pits, filled them with fire, and roasted more meat. When they could no longer eat, they lay on the ground and slept the night through, unmolested by the citizens of the near-by city.

Early the next morning the pirates attacked Panamá Viejo. It fell after nine hours of fighting, amidst an orgy of burning, looting, raping, and murdering.

The city was burned to the ground, even before the looting was completed. Gold, silver, jewels, men, women, children were all considered treasure—all were taken. The loot was worth several million dollars, yet it was not as much as had been expected. Much was lost in the fire, and the treasure ships, forewarned, had turned back to Peru. The church treasures, too — massive silver railings from the cathedral, solid gold plates and cups from the altar, jewel-encrusted vestments — had been loaded into a ship and sent out to sea. The same ship carried the old men, the women of wealth, priests, nuns, and some family treasure.

After a month of reveling, the pirates left the city a pile of ruins still smoldering in the tropic heat and set out for the Caribbean with their loot loaded onto 75 burros, their 600-odd prisoners walking behind, destined for the Jamaica slave market.

Those that had fled returned to Panamá Viejo and rescued what they could, but the city was never rebuilt. In its place, the modern Panama City arose several miles up the coast on a more easily defendable site. Today, Old Panama stands surrounded by jungle, washed clean of its fire scars by three centuries of tropical rains, its gutted beauty a memorial to the pride and weakness of the Spaniards. END

TEA-TIME IN THE ROCKIES

Benjamin Draper

A brief footnote to Rocky Mountain botany accompanied by a splendid wet-plate photograph taken on the spot.

FOR A NOTABLE TEN WEEKS during the summer of 1877 two leading botanists, Asa Gray and Sir Joseph Dalton Hooker, rambled through the Rockies, parts of the Sierra, and coast ranges from Monterey to Mt. Shasta. Comparing Old and New World botany, they examined species both had earlier had a part in classifying and describing.

For a decade, Ferdinand V. Hayden had been exploring and surveying the West. The company of scientists, collectors, and artists who journeyed with Hayden into the unknown reaches of the Rockies left scientific records that today constitute the background of New World natural history.

Many of these adventuring scientists, although they scrupulously omitted the personal and exciting aspects of their lives from scholarly papers, have left other records — memoirs, letters, and sketches—that supply the sprightly details of field work in pioneer times. Hooker and Gray both wrote good accounts of their journey with Hayden in the West.

While by 1877 it was possible to cross the continent "in the cars," the Alpine regions which the two botanists headed for were accessible only by wagon, horseback, and on foot. "Mrs. Gray accompanied us," her husband wrote to de Candolle, "and enjoyed it much, enduring well the occasional camp life and such hardship as there was."

On this journey, his only one to North America, Hooker stopped off at the Colorado silver camp, Georgetown, "at the extreme finger-end of civilization." He observed that "the streets were watered better than at Kew, that people slept without locks to their doors, and that the fire engines were well-manned and in capital order." Gray climbed to the 14,000-foot summits of neighboring Gray's and Torrey's peaks that had been named for him and John Torrey some fifteen years earlier.

Although the two scientists on this extensive journey were interested in geographical relations of Continental American floras, they actually pro-

GRAY-HOOKER BOTANIZING PARTY IN CAMP AT LA VETA PASS, COLORADO IN THE SUMMER OF 1877

—from an original at Claremont College, courtesy of Lyman Benson

Tea-time, regularly observed, was a period for discussion and handing around of specimens. Table-cloth and jar of jelly offer sharp contrast to coffee-pot and camp stove. Professor Asa Gray is seated on the ground. To his right is Sir Joseph Dalton Hooker. At the right of the table, holding a cup, is Ferdinand V. Hayden. General Richard Strachey, in gray topper, holds a map. Across the table, in black, is Mrs. Strachey. Jane Loring Gray is wearing a veil; next to her is Dr. Sanborn. Standing behind General Strachey is James Stevenson. The buckskin-clad guide, the fisherman, cook, and man in the background, none of whom are identified, are probably army personnel from Fort Lyon or Fort Garland, which posts provided "nice tents and other furnishings" for the journey.

duced no significant work. Gray said that the summer "was a most enjoyable one in every particular, every way prosperous, but laborious" and fulfilled "an old promise of mine." The literature of the field is richer for *Vegetation of the Rocky Mountain Region,* a slim paper by Asa Gray and Sir J. D. Hooker, F.R.S., published in the Hayden *Surveys.* END

Naturalists in the Rockies

ROCKY MOUNTAIN NATURALISTS. By Joseph Ewan. The University of Denver Press, Denver, Colorado. December 1950. 358 pp., illus., end papers. $5.00.

Both the author of this good book and the University Press which published it are to be congratulated on another of a series of regional naturalist books following the pattern of Samuel Wood Geiser's *Naturalists of the Frontier,* a Southern Methodist University Press publication of 1937 and 1948. Here is an important service to scholars, well done, and certainly well within the scope of expectations from any University press.

Joseph Ewan has compiled biographical sketches of nine leading naturalists of the Rocky Mountain West, hitherto published in *Trail and Timberline,* the relatively inaccessible journal of the Colorado Mountain Club. He has added "a roster in biographical dictionary form" of collectors whose dates range between 1682 and 1932. Everyone from Escalante to a Denver trolley conductor whose botanizing has added to several herbaria are among those listed.

Mr. Ewan's work will be a useful book for a good many years to come for he has been generous with footnotes and reference citations. His research has taken him to most of the herbarium and historical collections in his field. He has consulted a great many of the authorities in the country and has indicated many a treasure-trove for seekers after more detailed information.

The historian who is digging about in the New World will do well to thumb through Mr. Ewan's roster. He may find his man, some new friends, and probably a half-dozen references worth following. The work is more history than science history. Perhaps it lays the ground work for another book that will use the story of natural history discoveries in the West during its exploration period as a central theme. Mr. Ewan is well qualified to write such a companion volume.

BENJAMIN DRAPER

California Academy of Sciences
San Francisco

Octopi, crabs, and glass houses

SEASHORE TREASURES. By Charles Howard Edmondson. Pacific Books, Palo Alto, California. 1949. 144 pp., 186 photos, 69 drawings. $3.50.

To write an interesting popular book on marine biology for the teen-age natural history student is no simple problem. Few have been written and most of those have not been successful. Professor Edmondson solves the problem with 36 short concise chapters and many illustrations. It should be pointed out that in any book on marine biology the illustrative material is most essential, for even the best text is often a total loss without adequate photographs and drawings. The reviewer, being "octopus-conscious," was delighted to find a good photo of an octopus beak, for this important structure is often not considered in other texts. The book presents much stimulating information in a manner that both student and non-student will find interesting. Although based primarily upon the Hawaiian fauna, most parts of the book will also be applicable to the southern sections of the United States. Scientific names and terms have been held to a minimum. The chapter headings are appealing, with such titles as "The Finny Tribe," "Sea Slugs," "Double Jointed Animals," "The Noise Makers," "Flower-like Animals," etc.

The chapter, "Housing Problems of Crustaceans," brings to mind some of the experiments currently being made at Steinhart Aquarium using glass shells for hermit crabs. If there is any housing available, the hermit crab will invariably seek it out. Consequently, placing a naked hermit crab in a small aquarium, together with a glass shell, invariably results in the hermit crab quickly popping into the transparent house. Thus no secret of the hermit crab is hidden behind the usually opaque shell. In the chapter, "Crustaceans as Parasites," mention is made of the parasitic barnacle which attaches to crabs. The Steinhart Aquarium recently received some deep-sea crabs from the California Fish and Game vessel *N. B. Scofield.* Six of the twelve specimens were parasitized by this barnacle, and each parasite appeared as a dark red sausage about 2.5 inches long attached to the underside of the abdomen. Strangely enough the parasite is reputed to cause a sex reversal by its infiltration into the reproductive tissue within the body of the host.

Reading Dr. Edmondson's *Seashore Treasures* is recommended as an easy way to spend several stimulating hours.

EARL S. HERALD

Steinhart Aquarium
California Academy of Sciences

Geographers on the Pacific

GEOGRAPHY OF THE PACIFIC. Edited by Otis W. Freeman. John Wiley & Sons, Inc., New York. 1951. xii + 573 pp., 156 figs. including photographs, maps, charts, graphs. $10.00.

This new *Geography of the Pacific,* a textbook, is an exceedingly valuable addition to a reference shelf on the Pacific Ocean and its island world. Its scope may be indicated through the subjects of its 19 chapters by 13 authors who are all members of college faculties from Michigan to Hawaii and of the Bishop Museum staff:

Chapters 1, 2, and 3 cover the geographic setting, native peoples, exploration and mapping of the Pacific; chapters 4 and 5, Australia; chapter 6, New Guinea and the Bismack Archipelago; chapter 7, eastern Melanesia; chapter 8, the Mariana, Volcano, and Bonin islands; chapter 9,

the Carolines; chapter 10, Micronesia; chapter 11, the Philippines; chapter 12, Hawaii and American island outposts; chapter 13, eastern Polynesia; chapter 14, central and western Polynesia; chapter 15, New Zealand; chapter 16, Indonesia; chapter 17, the Kuril and Ryukyu islands; chapter 18, islands of the eastern and northern Pacific; chapter 19, trade, transportation, and strategic location in the Pacific. Each chapter has a considerable list of references, hence the book is also an excellent Pacific bibliography.

A well-packed compilation of descriptive, historical, and statistical matter, this book belongs at the elbow of everyone—every editor, for instance—who deals with Pacific material. D.G.K.

Geographers on their science

GEOGRAPHY IN THE TWENTIETH CENTURY: A *Study of Growth, Fields, Techniques, Aims and Trends.* Edited by Griffith Taylor. Philosophical Library, New York. Methuen, London. 1951. x + 630 pp., illustrated. $8.75.

Most of us were exposed in the primary grades to something called Geography, a descriptive catalog of countries and states, cut, dried, and packaged in a large book with pictures of Eskimo children, Vesuvius, cotton pickers in Alabama, and the Bund at Shanghai. Most of us developed just enough of a case, as with the measles, to be sure of never catching it again. Of course, World War II rudely reminded us of both history and geography with the same jolt, probably even planting the suspicion that the two were somehow fatefully connected. The geographers, meanwhile, have been quietly and persistently developing their discipline to the proportions of a major science, one which plays a far greater part in the lives of all of us than most of us realize.

What geographers have been doing the last half century, how the science grew out of its earlier beginnings, and what have become some of its modern preoccupations are the chief facets of this unique book by an international score of authors under the editorship of and including the dean of North American geographers, Professor Griffith Taylor of the University of Toronto. The 26 chapters are grouped in three parts, under the headings, "Evolution of Geography and its Philosophical Basis," "The Environment as a Factor," and "Special Fields of Geography."

Though it might be inferred, not altogether wrongly, that reading a book written primarily for students and teachers of geography would, for even the well above average layman, be catching up on an almost totally neglected subject the hard way, there are under those stiff-sounding headings some chapters and sections that make good armchair reading. Best of this sort is doubtless Professor Taylor's "Exploration of Antarctica." And such subjects as "Racial Geography," "Geography and Aviation," and "Geopolitics and Geopacifics" should contribute to every thoughtful citizen's fuller understanding of the present and future problems of a world become complex under dangerously high tension. D.G.K.

Physics, "firsts," and flowers

THE NEW PHYSICS: *Talks on Aspects of Science.* By Sir C. V. Raman. Philosophical Library, New York. 1951. 144 pp. $3.75.

Sir Chandrashekhar Venkat Raman in 1930 won the Nobel Prize in Physics for his discovery of the Raman effect. There should also be a prize that could be awarded this professor of physics in the University of Calcutta for the direct, humorous, yet philosophical way he can talk to laymen on such matters as "Geometry in Nature," "The Sensations of Light and Colour," "Physics of the Countryside: The Soil" (and "The Water" and "The Weather"), "Atmospheric Electricity," "Modern Physical Concepts: Structure of the Crystal" (and "Cosmic Rays"), "The Stellar Universe"—to mention nine of his nineteen subjects.

Although these essays reached first the Indian people via radio, Professor Raman, "one of the most humorous and fluent speakers in the English language," is a world scientist talking of universal matters to all people. That he happens to be an Indian might give certain Westerners something to reflect on.

ON THE ORIGIN OF SPECIES BY MEANS OF NATURAL SELECTION. By Charles Darwin. A reprint of the First Edition, with a Foreword by Dr C. D. Darlington, F.R.S. Philosophical Library, New York. 1951. xx + 426 pp. $3.75.

Here in pocket format but with clear type is the first reprint of the First Edition (1859), the only changes being in punctuation. "All other reprints of Darwin's epoch-making work since 1859 have been made from partially expurgated later editions. In view of the conflicts—now as violent as ever before—in the interpretation of 'Darwinism,' the reproduction of the book as it was originally written . . . will be welcomed by students of Evolution—laymen and scientists alike" (publisher's statement).

AN ILLUSTRATED MANUAL OF CALIFORNIA SHRUBS. By Howard E. McMinn. Second printing. University of California Press, Berkeley and Los Angeles. 1951. xi + 663 pp., 775 figs. (drawings and photographs). $6.50.

A MANUAL OF THE FLOWERING PLANTS OF CALIFORNIA. By Willis Linn Jepson. Second printing. University of California Press. Berkeley and Los Angeles. 1951. 1238 pp., 1023 line drawings. $5.00.

In various fields certain reference works have become standard, and absolute necessities to serious students. The demand is continuous and must be met. In the case of these two indispensable botanical manuals, the University of California Press has this spring renewed the supply—McMinn's *Manual* was first published by Stacey, Jepson's by the Associated Students Store on the Berkeley campus. These two reprints illustrate another, newer truth: given clean page proofs of an original letterpress edition, we can now have from the photo-offset printer a copy that is nowise inferior—and very much cheaper. Every botany student can afford these basic texts.

The Jepson is reprinted without change. The McMinn has been added to, and revised in some degree.

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"Why should you be in all parts of the oil business?"

Mrs. Henry Lincoln, housewife in Boise, Idaho, asks: *"Do you have to be in all parts of the oil business? Why don't you just produce or refine, and give other companies a chance to do the transporting, selling, etc.?"* Mrs. Henry Lincoln

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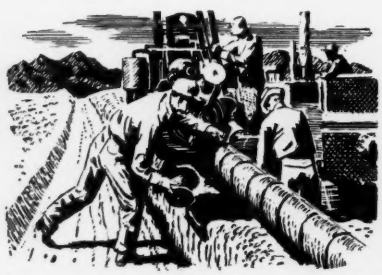
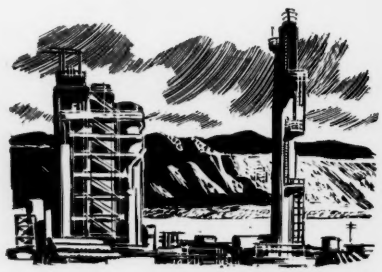
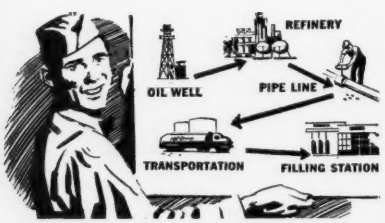


And to move the crude. Standard laid a pipeline to Salt Lake City. This called for an especially big investment because the 182 mile long line is the world's highest: crosses the Uinta Mts. at 9560 feet.



Next—a new Standard refinery at Salt Lake City. It cost over $15 million. But to keep costs down, it must operate continuously—have constant supply of crude, constant movement of product.

Another long pipeline was then built on up to the Northwest. Gasoline and fuel oil made from Rangely crude now go where they're needed—lower in cost, plentiful no matter how tough the winter.



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